PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : D04B 35/32

A1

(11) International Publication Number: WO 95/09259

(43) International Publication Date: 6 April 1995 (06.04.95)

(21) International Application Number: PCT/GB94/02131

(22) International Filing Date: 30 September 1994 (30.09.94)

(30) Priority Data:

9320201.8	30 September 1993 (30.09.93)	GB
9323743.6	18 November 1993 (18.11.93)	GB

(71) Applicant *(for all designated States except US)*: ALAN SHELTON LIMITED [GB/GB]; Winston Avenue, Croft, Leicester LE9 6GQ (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: SHELTON, William, Ewart, Alan [GB/GB]; Alan Shelton Limited, Winston Avenue, Croft, Leicester LE9 6GQ (GB). SHELTON, Mark, Alan [GB/GB]; Alan Shelton Limited, Winston Avenue, Croft, Leicester LE9 6GQ (GB).

(74) Agent: COOPER, Derek, Robert; E.N. Lewis & Taylor, 144 New Walk, Leicester LE1 7JA (GB).

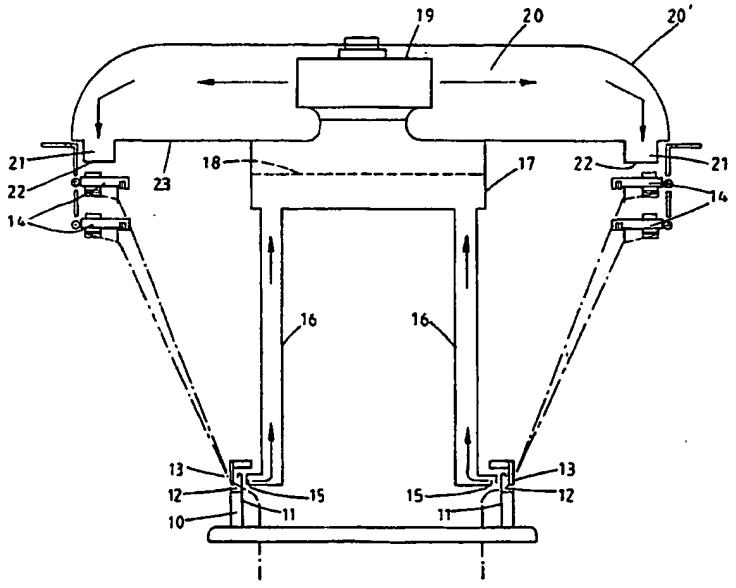
(81) Designated States: JP, KR, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: CLEANING SYSTEM FOR KNITTING MACHINES



(57) Abstract

In a circular knitting machine, a series of nozzles (15) are positioned closely adjacent to points (13) at which the knitting takes place. A fan unit (19) draws air in through the nozzles (15) via ducting (16) and thereby creates a localised suction effect at the knitting points (13). The air is then passed to a duct (20) which extends over the top of the knitting machine proper, and is emitted through a series of peripheral ducts (21) in a downward direction and towards feed devices (14) which feed yarn to the knitting points (13). In a modified arrangement (Fig. 2), the ducting (16) is replaced by a single central duct (30) which terminates just above the level of the knitting points (13) to create a generally annular suction area (33).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

Title: **Cleaning System For Knitting Machines**

This invention relates to a knitting machine having a cleaning system for removing lint.

The generation of lint when knitting cotton yarn occurs in two main areas: firstly, around wheels which feed the yarn to the machine (where there are many contact points at which fibres are released from the yarn), and secondly at the knitting points themselves (again due to contact between the yarn and the machine components, but also due to yarn-yarn contact during loop formation). It is undesirable that this lint should become deposited on sensitive mechanisms of the knitting machine. Accordingly, current practice is to mount fans on the machine which rotate or reciprocate in the appropriate areas.

Typically, axial fans are mounted to rotate/reciprocate in the centre of the machine, on the one hand at the level where the feed wheels are mounted, and on the other hand inside the needle cylinder, blowing air outwardly through the needles, yarn feed points, etc. There are, however, drawbacks with this existing technology. Because the air around the machine is generally lint laden, blowing such air at parts required to be kept clean is not good practice. Inevitably, this lint laden air is entrained through the fans and therefore directed at the sensitive mechanisms. Moreover, many of the air streams created by these fans are at best horizontal (in the case of the needle cylinder fans, blowing radially outwards) and in many cases are pointed partially upwards. For this reason, lint which is removed is directed to float off into the surroundings, causing problems of contamination on adjacent machines, etc. In addition, the air flow over a given part of the machine is intermittent due to the rotation/reciprocation of the fan assemblies to cover all

areas. Furthermore, these fan systems require "slip ring" electrical transmission boxes and multiple fans to reach the relevant areas, giving rise to maintenance problems.

As an alternative to this, cleaning can be performed by means of compressed air. Although this has the advantage that the air blown over the various parts of the machine is clean, compressed air systems are nevertheless rather expensive.

It is an object of the present invention to obviate or mitigate these problems.

According to the present invention, there is provided a knitting machine in which yarn is knitted at knitting points and is fed to the knitting points by feed devices, the knitting machine comprising at least one suction duct disposed at or closely adjacent to the knitting points, air circulation means operative to draw air in through the suction duct or ducts and thereby create a localised suction effect at the knitting points, duct means to which air is passed by the air circulation means and from which said air is emitted towards the yarn feed devices, and filter means through which the air passes in between being drawn in through the suction duct or ducts and being emitted from the duct means.

Desirably, the air is emitted from the duct means towards the yarn feed devices in a downward (and preferably substantially vertical) direction.

Advantageously, the knitting machine is a circular knitting machine, and the air circulation means is disposed generally centrally thereof.

Conveniently, the air circulation means comprises a single fan unit which is connected to the suction duct or ducts by way of a duct or ducting.

Preferably, the duct means communicates with a first chamber which extends abov the knitting machine proper, the filter means is disposed in a second chamber positioned below the first chamber, and the air circulation means is operative to draw air from the second chamber and emit said air into the first chamber. In this case, the air circulation means is desirably a centrifugal fan unit which is disposed in the first chamber.

Said at least one suction duct can comprise a series of nozzles each of which is disposed adjacent to a respective one of the knitting points. Alternatively, said at least one suction duct can comprise an arcuate duct which extends across the knitting points.

The invention will now be further described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic sectional side view of a knitting machine according to the present invention; and

Figures 2 and 3 are schematic sectional side views of two modified forms of knitting machine, also according to the present invention.

Referring first to Figure 1, the illustrated knitting machine is of the circular type and contains a cylindrical bed 10 on which needles 11 are mounted for sliding movement in a conventional manner, for knitting yarn at knitting points 12. Yarn is supplied to the knitting points at feed points 13 by way of respective feed devices 14 which are mounted in a circular array around the upper part of the knitting machine.

Closely adjacent to the knitting points 12 there are provided suction ducts in the form of a series of nozzles 15 which communicate via ducting 16 with a manifold chamber 17 in which

a filter 18 is disposed. A centrifugal fan unit 19 is positioned directly above the chamber 17 within a further chamber 20. The ducting 16, chamber 17 and fan unit 19 are all positioned centrally of the knitting machine, while the chamber 20 extends over the top of the latter beneath a canopy 20^1 . At its periphery the canopy 20^1 has a series of ducts 21 which communicate with the chamber 20 and which have openings 22 directed substantially vertically towards the feed devices 14. A horizontal plate 23 seals the bottom of the chamber 20 from the remainder of the knitting machine.

In use, the fan unit 19 draws air in through the nozzles 15, thereby creating a localised suction effect at the knitting points 12. Because it is possible to apply considerable suction forces in very close proximity to the lint sensitive areas of the needles 11 and the feed points 13, this is highly efficient in removing lint generated at the knitting points, and ensures the lint is not blown over sensitive components of the machine. The air is then drawn up through the ducting 16 to the chamber 17 where it passes through the filter 18 to remove the entrained lint. Thereafter, the air is drawn vertically upwardly from the chamber 17 into the fan unit 19 itself and is emitted from the latter outwardly into the chamber 20 in a generally radial direction. This configuration of the chambers 17 and 20 and the fan unit 19 takes maximum advantage of the centrifugal properties of the latter. Finally, the air is emitted through the openings 22 in the ducts 21, to flow downwardly over the feed devices 14 in a substantially vertical direction. Lint generated by contact of the yarn with those devices is thereby entrained in the downward air flow and is pushed to the floor of the workroom in which the knitting machine is disposed, where it settles and can be collected by conventional means. Such settlement on the floor is preferable to having the lint air borne in the surrounding environment.

The filter can be cleaned periodically, or alternatively can be in the form of a disc which is rotated against a suction nozzle so that the accumulated lint is continuously removed.

By using the cleaning system described above, lint can be effectively removed from the most sensitive lint generation points using only a single fan unit disposed centrally of the knitting machine, thereby avoiding the need for multiple fans and for complicated slip ring assemblies and mounting bracketry. Moreover, the air flowing through the system is put to two important uses, namely cleaning both the knitting points and the yarn feed devices. Furthermore, the overall arrangement is highly compact and requires no externally housed fans, filters, etc.

Figure 2 shows a modified form of knitting machine in which the nozzles 15 and the ducting 16 are replaced by a cylindrical chamber 30 which is disposed centrally of the knitting machine. The chamber 30 extends vertically downwardly from the manifold chamber 17 and terminates at a level just above that of the needles 12 and the feed points 13. At its lower end at least, the width of the chamber 30 corresponds approximately to that of the circular needle bed (designated 31) and of the feed ring (designated 32). A generally annular or arcuate suction duct 33 is thus created at the bottom end of the chamber 30 and adjacent to the needles 12 and the feed points 13. The side wall of the chamber 30 is preferably made from transparent material.

In addition, the outer periphery of the canopy 20 is now configurated to turn the air stream inwardly as well as downwardly through the feed devices 14, and thence towards the suction area 33.

These modifications have the effect of isolating the air circulation within the knitting machine from the surrounding

environment. Where several such machines are provided in a work room, this is important in preventing cross-contamination (e.g. of coloured lint) between the machines.

Figure 3 shows a further modification wherein the fan unit 19 is disposed remotely from the knitting machine and communicates with the cylindrical chamber 30 by way of a duct 34, air being fed back from the fan 19 to the feed devices 14 by way of a further duct 35. The fan unit 19 is positioned at ground level for ease of maintenance, and the ducts 34 and 35 are of generally arched configuration to allow an operator all-round access to the knitting machine itself. A filter bag 36 is positioned at a lower end of the duct 34, and the air is sucked through this bag immediately prior to passing through the fan unit 19. The bag 36 is also disposed at or around ground level for ease of replacement and/or cleaning.

Claims

1. A knitting machine in which yarn is knitted at knitting points and is fed to the knitting points by feed devices, the knitting machine comprising at least at least one suction duct disposed at or closely adjacent to the knitting points, air circulation means operative to draw air in through the suction duct or ducts and thereby create a localised suction effect at the knitting points, duct means to which air is passed by the air circulation means and from which said air is emitted towards the yarn feed devices, and filter means through which the air passes in between being drawn in through the suction duct or ducts and being emitted from the duct means.

2. A knitting machine as claimed in claim 1, wherein the air is emitted from the duct means towards the yarn feed devices in a downward direction.

3. A knitting machine as claimed in claim 2, wherein the air is emitted from the duct means towards the yarn feed devices in a substantially vertical direction.

4. A knitting machine as claimed in any preceding claim, wherein the air circulation means comprises a single fan unit which is connected to the suction duct or ducts by way of a duct or ducting.

5. A knitting machine as claimed in any preceding claim, in the form of a circular knitting machine wherein the air circulation means is disposed generally centrally thereof.

6. A knitting machine as claimed in any preceding claim, wherein the duct means communicates with a first chamber which extends above the knitting machine proper, the

filter means is disposed in a second chamber positioned below the first chamber, and the air circulation means is operative to draw air from the second chamber and emit said air into the first chamber.

7. A knitting machine as claimed in claim 6, wherein the air circulation means comprises a centrifugal fan unit which is disposed in the first chamber.

8. A knitting machine as claimed in any preceding claim, wherein said at least one suction duct comprises a series of nozzles each of which is disposed adjacent to a respective one of the knitting points.

9. A knitting machine as claimed in any one of claims 1 to 7, wherein said at least one suction duct comprises an arcuate duct which extends across the knitting points.

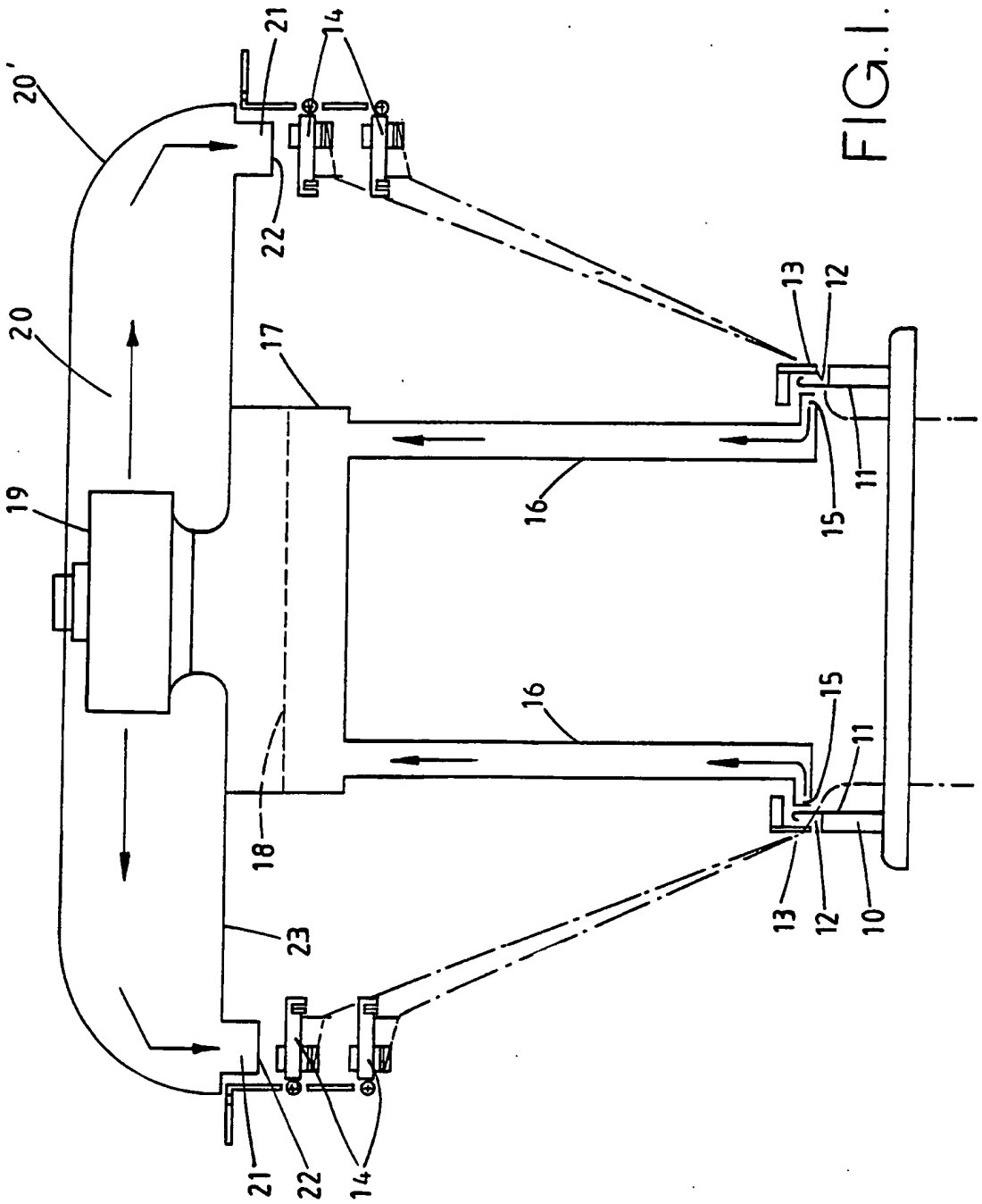


FIG. 1.

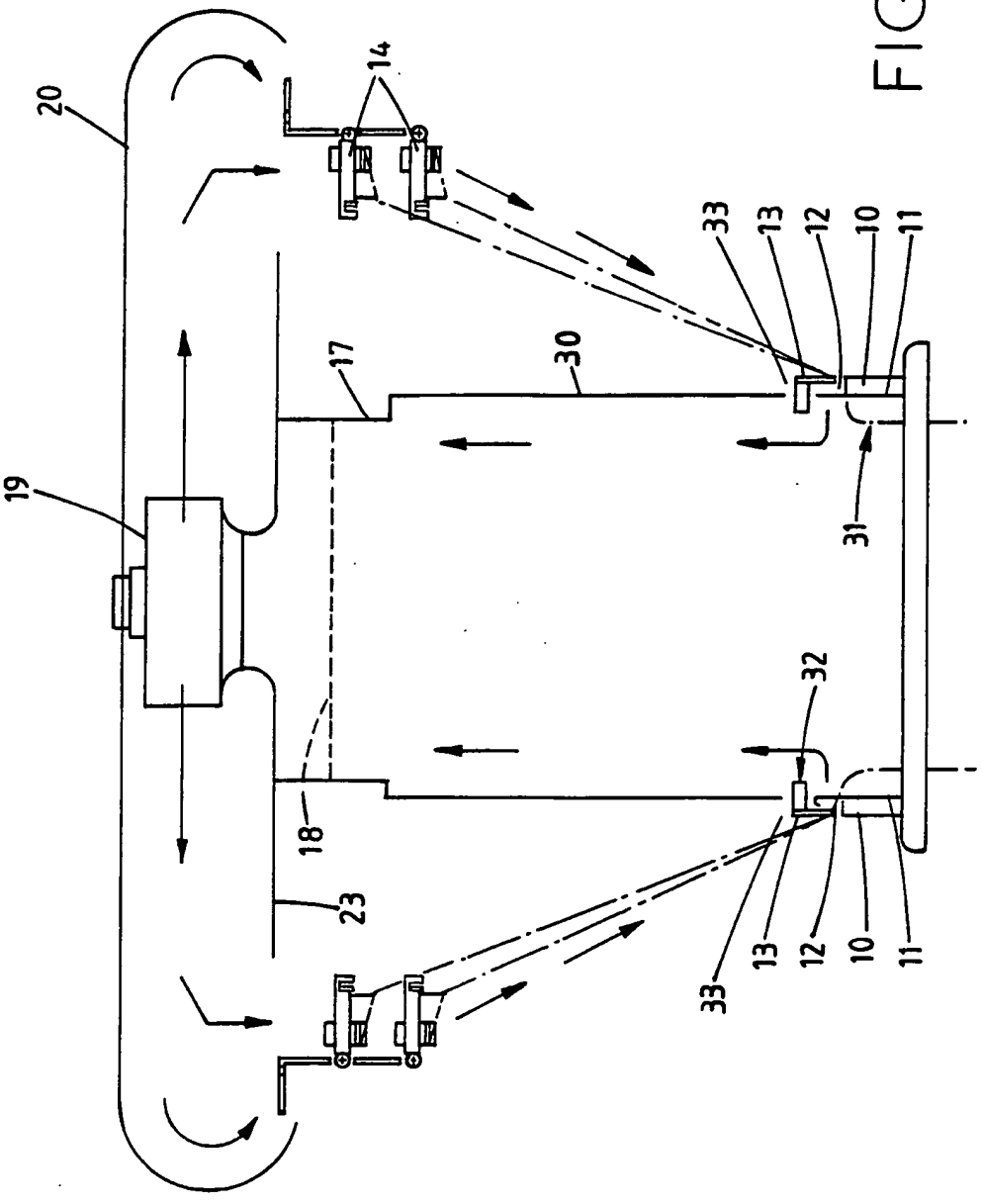
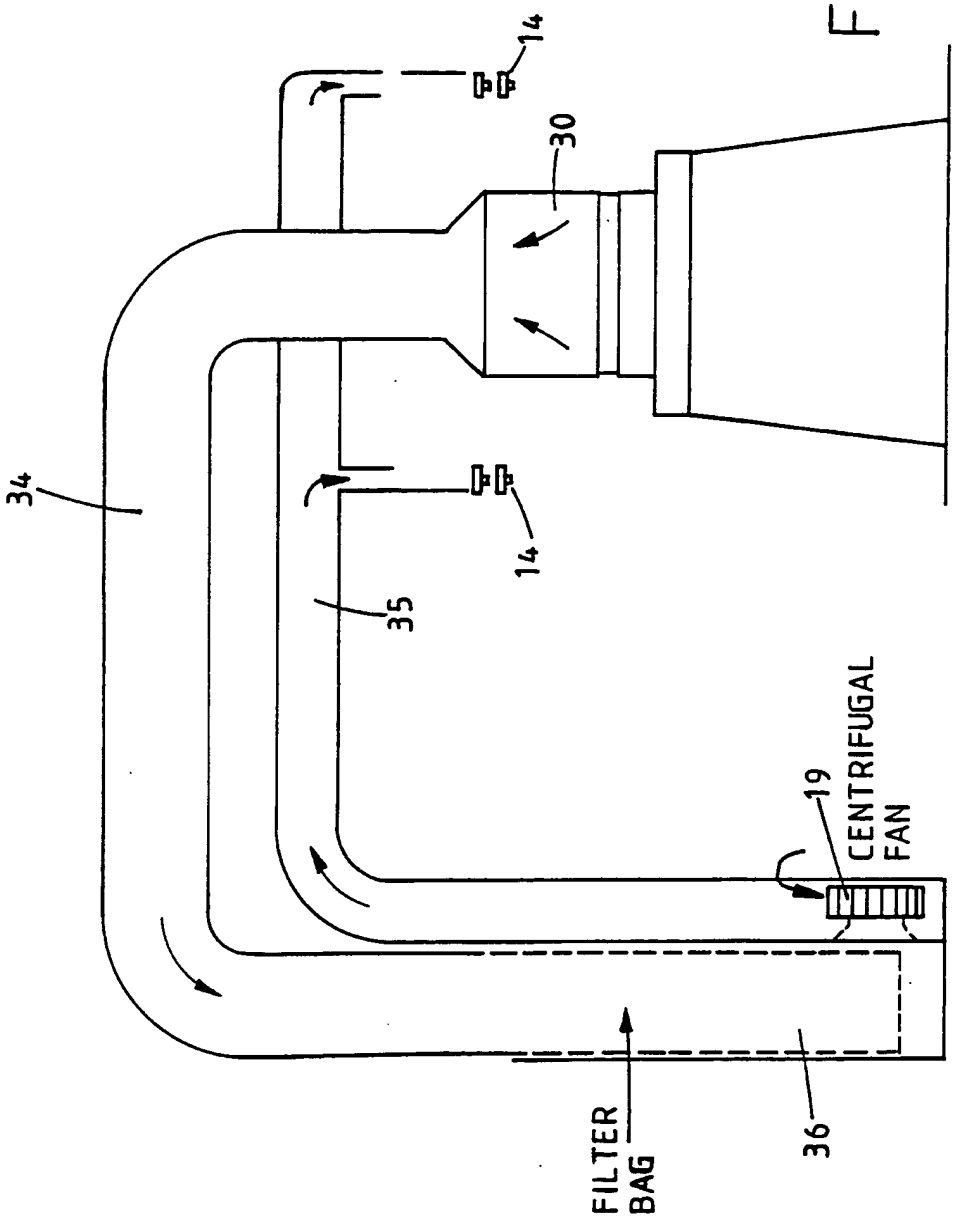


FIG.2.

FIG.3.



INTERNATIONAL SEARCH REPORT

Interr al Application No
PCT/GB 94/02131

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D04B35/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 510 508 (PRECISION FUKUHARA WORKS) 28 October 1992 see column 5, line 45 - column 6, line 24; figure 1 ---	1,4,5
A	CH,A,489 653 (LUWA AG) 30 April 1970 see column 5, line 19 - line 31; figure 4 ---	1,8
A	CH,A,527 942 (ETUDES ET BONNETERIE S.A.) 15 September 1972 see column 3, line 16 - column 4, line 3; figure 1 ---	1,2,4,5
A	FR,A,657 965 (MARATTI S.A.) 29 May 1929 ---	
A	DE,A,16 35 971 (UNIVEG GMBH & CO, KG) 16 June 1971 ---	
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 December 1994	24. 01. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Van Gelder, P

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/GB 94/02131

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE,A,16 35 796 (FOUQUET-WERK, FRAUZ & PLANCK) 6 May 1971 ---	
A	GB,A,2 196 350 (H. STOLL GMBH & CO.) 27 April 1988 -----	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. ial Application No
PCT/GB 94/02131

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0510508	28-10-92	JP-A-	5009852	19-01-93
		US-A-	5177985	12-01-93
CH-A-489653	30-04-70	DE-A,C	1585163	23-03-72
CH-A-527942	15-09-72	NONE		
FR-A-657965		NONE		
DE-A-1635971	16-06-71	NONE		
DE-A-1635796	06-05-71	NONE		
GB-A-2196350	27-04-88	DE-A-	3635096	21-04-88
		CH-A-	673665	30-03-90
		FR-A-	2605334	22-04-88
		JP-A-	63105159	10-05-88
		US-A-	4765158	23-08-88